TENNESSEE VALLEY AUTHORITY

CHATTANOOGA, TENNESSEE 37401
1630 Chestnut Street Tower II

April 9, 1985

Director of Nuclear Reactor Regulation
Attention: Ms. E. Adensam, Chief
Licensing Branch No. 4
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Ms. Adensam:

In the Matter of the Application of) Docket No 50-390
Tennessee Valley Authority)

On April 2, 1985, TVA and NRC representatives met to discuss various power system issues associated with the Watts Bar unit 1 technical specifications. During this meeting, TVA committed to provide additional information on several of the issues which were discussed. Enclosed is the information on several of these items. Consistent with the April 2 discussion, it is anticipated that this information will resolve these issues. Information on the remaining issues will be forwarded in the near future.

If you have any questions concerning this matter, please get in touch with D. B. Ellis of my staff at FTS 858-2681 in Chattanooga.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

R. H. Shell

R. H. Shell
Nuclear Engineer

Sworn to and subscribed before me
this 9th day of April 1985
Paulette H. White
Notary Public
My Commission Expires 8-24-88

Enclosure
cc: U.S. Nuclear Regulatory Commission (Enclosure)
Region II
Attn: Dr. J. Nelson Grace, Regional Administrator
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

B001
1/1

Enclosure

TECHNICAL SPECIFICATION 4.8.1.1.1.b - 6.9 kV SHUTDOWN BOARDS

TVA believes that the requirements of 10 CFR 50 Appendix A, General Design Criteria 17 are satisfied by ensuring the first alternate supply to the 6.9 kV shutdown boards via the common station service transformers C or D is available. Therefore, the technical specifications should not require testing of the automatic manual transfer of the 6.9 kV shutdown boards to their second alternate supply. FSAR section 8.2.1 will be modified to clarify this position.

Diesel Generator Batteries

Battery Chargers

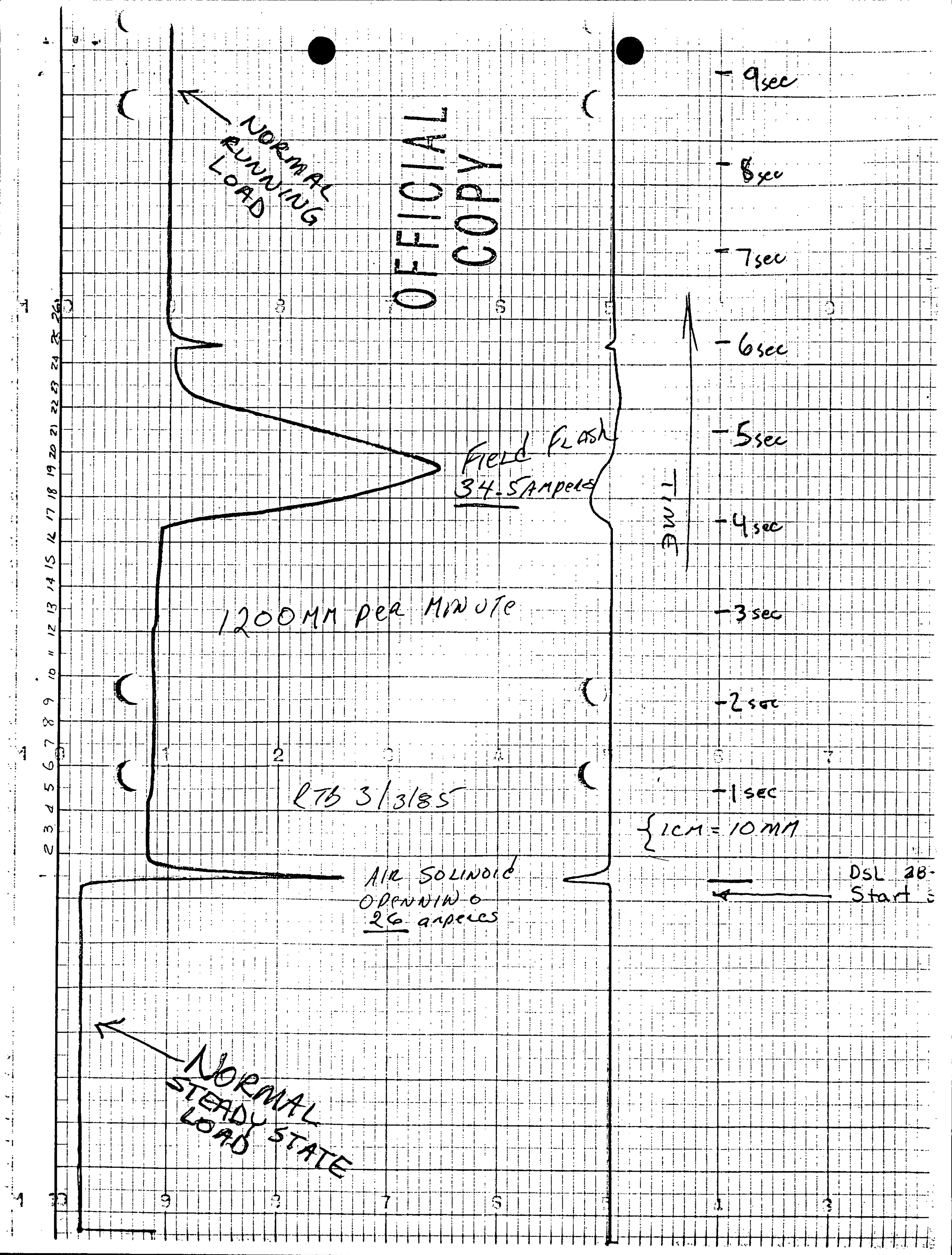
The diesel generator battery charger normally maintains the battery on float charge and energizes the "loss of power" or "blown fuse" alarm relays in the diesel generator control panel. This load is approximately 2 amps as noted on the attached preoperational test data. The normal load when the diesel generator is running is approximately 10 amps. TVA believes that the weekly check on battery float charge and distribution panel status coupled with the quarterly check on battery parameters (surveillance requirements 4.8.1.1.3.a and 4.8.1.1.3.b) and periodic diesel generator tests (surveillance requirement 4.8.1.1.2.a) give adequate assurance that the diesel generator battery charger is performing its safety function. An 18 month load test will provide no additional assurance and, therefore, would be an unnecessary testing burden on the plant maintenance staff.

Battery Service Test

The addition of a separate 18 month battery service test surveillance requirement is not warranted. The objectives of this test are accomplished every 18 months by performance of the blackout and blackout/safety injection tests required by surveillance requirements 4.8.1.1.2.f.4 and 4.8.1.1.2.f.6. The loss of power to the battery chargers that occurs during black-out testing causes the DG batteries to deliver appropriate power for control, normal load running current and field flashing current as per section 5.6 (2 and 3) of IEEE standard 450-1975. The inclusion of a separate service test requirement would create the need for a separate surveillance instruction and concomitant record retention and review requirements (technical specification 6.10.1). Adding a duplicate surveillance requirement for a test already being performed does not meet good human factor principles. TVA would consider the addition of a diesel generator battery service test requirement as an unnecessary burden on the plant staff that provides no corresponding increase in plant safety.

Battery Capacity Test

The diesel starting load on the battery consists of a 0.25 second load peaking at 26 amps to open the air solenoid, a 1.5 second load peaking at 34.5 amps to flash the generator field, and the 10 amp running load. The total amp-hour load on the battery until the generator is tied onto the shutdown board is 0.035 amp-hour. The battery capacity far exceeds this requirement because the battery capacity is measured in amp-hours not a fraction of an amp-hour. Again, TVA believes that the weekly check and quarterly checks on the battery coupled with the diesel generator starting tests are sufficient to establish that sufficient battery capacity exists. TVA believes the addition of a 60 month diesel generator capacity test requirement as an unnecessary burden on the plant maintenance staff.


9sec
8sec
7sec
6sec
5sec
4sec
3 sec
2 sec
1 sec
NORMAL RUNNING LOAD
OFFICIAL COPY
Field Flash
34.5 Amperes
TIME
1200MM per Minute
LTB 3/3/85
1CM = 10MM
AIR SOLINOID OPENNING 26 amperes
DSL 2B-
Start
NORMAL STEADY STATE LOAD

Diesel Generator/6.9kV Shutdown Board Blackout Safety Injection Sequence Timers - Technical Specification 4.8.1.1.2.f.10

Reference: Memorandum from W. T. Cottle to J. W. Hufham dated March 22, 1985 (TOO 850322 834)

The referenced memorandum provided information addressing recent NRC questions concerning items which TVA had previously submitted to and received approval from NRC and which are presently incorporated into the certification copy of the draft technical specifications. One of these items concerns the diesel generator load sequence timers following blackout conditions. The NRC staff has subsequently asked for additional information concerning our compliance with position C.4 of Regulatory Guide (RG) 1.9 Rev 2.

As identified in FSAR section 8.1.5.3, Watts Bar has committed to comply with position C.4 of RG 1.9 Rev 2. Attached is data taken from preoperational tests TVA 13B and 13C which demonstrates our compliance with position C.4.

Attachment 1 provides test data from 6.9kV shutdown boards 1A-A and 1B-B. Shutdown boards 2A-A and 2B-B are only lightly loaded for unit one operation and thus data from those boards is not pertinent. The table provides voltage swings, frequency swings, and the time taken to recover to nominal settings (as defined in the RG) for each load.

Attachment 2 provides allowable timer bands as identified in the proposed FSAR Table 8.3-3 provided in the referenced memorandum. These allowable values are those used in the plant surveillance instruction to set and verify proper operation of the load sequence timers. The third column provides the timer band expanded by the accuracy of the timers (5% of setting for times below 200 sec). The next column provides the most conservative interval between tying on loads by use of the timer bands adjusted for timer accuracy (column 3). The last column is calculated by taking 60% of the conservative interval. This is the timeframe allowed by RG 1.9 position C.4 for the diesel generator to recover to nominal settings after each load is tied in.

As shown by inspection of Attachments 1 and 2 for both diesel generators, the only loads that did not return to nominal values within 60% of the most conservative time interval was the initial load associated with the closing of the diesel generator feeder breaker to the shutdown boards (i.e., the loads that do not shed from the board). However, as allowed by the RG, a greater percentage of the time interval can be used if justified. The following is that justification:

The only variance from the 60% of interval guidance is on the frequency for the initial tying onto the shutdown board. Diesel generator 1A-A used 66% of the interval and diesel generator 1B-B used 79% of the interval to reach the 58.8 minimum frequency level. This is acceptable since the diesel generator actually ties to the board (i.e., feeder breaker closes) at 56.7 Hz. This is to ensure the diesel generator is not idling when the initial load is tied on. Thus, since the frequency starts below the minimum steady state value of 58.8, it is expected (and acceptable) that a larger percentage of the interval be used (this is documented in test deficiency PT-484). It should be noted that for all the sequenced loads, the frequency never even goes outside steady state values.

Also provided on Attachment 1 is data from preoperational test TVA-13C which simulated a step load increase of 1750 hp which is greater than any two sequenced loads combined. As shown, the diesel generator responded acceptably. This essentially demonstrates the capability of the diesel generator to withstand the overlapping of sequence timers.

As shown in the test data from preoperational test TVA 13B, Watts Bar is in compliance with position C.4 of RG 1.9 Rev 2.

0199K

ATTACHMENT 1

TVA 13B - 69kV SD Bd 1A-A

Seg	Equipment	Approx HP	Voltage Range	Time to Return Voltage w/i 10% of 6.9kV	Hz Range	Time Required to Return to w/i 2% of 60 Hz
0	Misc		5.512kV-6.86kV	0.5 sec (1 phase)	56-61.1	1.25 sec
1	CCP	600	6.86kV-6.3kV	0	59.3-60.0	0
2	SIP	400	6.468kV-6.86kV	0	59.3-60.2	0
3	RHR	400	6.35kV-6.97kV	0	59.3-60.2	0
4	ERCW	800	6.18kV-7.03kV	0.1 sec (2 phases)	59.0-60.0	0
5	CCS	350	6.3kV-7.0kV	0	59.2-60.0	0
6	Fire Pmp	200	6.69kV-6.86kV	0	59.4-59.9	0
7	AFWP	600	6.18kV-6.97kV	0.1 sec (1 phase)	59.3-59.7	0
8	CS Pmp	700	6.18kV-6.97kV	0.1 sec (1 phase)	58.8-60.4	0

TVA 13B - 6.9kV SD Bd 1B-B

Seg	Equipment	Approx HP	Voltage Range	Time to Return Voltage w/i 10% of 6.9kV	Hz Range	Time Required to Return to w/i 2% of 60 Hz
0	Misc		5.625kV-6.97kV	0.5 sec (1 phase)	56.3-60.2	1.5 sec
1	CCP	600	6.46kV-6.97kV	0	60.4-60.2	0
2	SIP	400	6.63kV-7.03kV	0	60-60.4	0
3	RHR	400	6.69kV-6.97kV	0	59.95-60.3	0
4	ERCW	800	6.24kV-7.19kV	0	59.9-60.25	0
5	CCS	350	6.74kV-6.97kV	0	60.1-60.19	0
6	Fire Pmp	200	6.74kV-6.97kV	0	60.1-60.2	0
7	AFWP	600	6.29kV-7.14kV	0	59.9-60.4	0
8	CS Pmp	700	6.41kV-6.97kV	0	59.6-60.25	0

TVA 13C - 1750 HP Single Step Load Increase

1B-B	5.17kV-7.38kV	0.8 sec	58-60	2.0 sec
1A-A	5.04kV-7.38kV	1 sec	56-60	4.0 sec

0196K

ATTACHMENT 2

Sequence	Allowable Timer Band (Sec.)	Timer Band Including Margin for Accuracy (Sec)*	Most Conservative Interval (Sec)	60% of Interval (Sec)
1	2.00 to 2.38	1.90 to 2.50	1.90	1.14
2	4.80 to 5.70	4.56 to 5.98	2.06	1.24
3	8.45 to 10.45	8.03 to 10.97	2.05	1.23
4	13.75 to 15.20	13.06 to 15.96	2.09	1.25
5	18.95 to 19.50	18.00 to 20.47	2.04	1.22
6	24.20 to 24.70	22.99 to 25.93	2.52	1.51
7	29.50 to 30.40	28.02 to 31.92	2.09	1.26
8	108.08 to 132.0	102.68 to 138.60	70.76	42.45

*5% accuracy on timers below 200 sec.

Vital Batteries

Charger Testing

Position C.1.b of Regulatory Guide 1.32, Revision 2, recommends that the "capacity of the battery charger supply should be based on the largest combined demands of the various steady-state loads and the charging capacity to restore the battery from the design minimum charge state to the fully charged state, irrespective of the status of the plant during which these demands occur." TVA has designed the battery charger to meet this recommendation. The Watts Bar charge is designed to deliver 200 amperes. This capacity is more than the design loads on the battery board (132 amperes) and the recharging current.

However, TVA has proposed that the technical specification surveillance requirement on the battery charger (SR 4.8.2.1.c.4) be written to require an 8 hour test at 150 amperes. TVA believes that the proposed test requirement of 150 amperes is consistent with the design of the system. The test verifies that the charger can supply the installed loads on the battery board (with 15 percent margin). This is the immediate safety-related concern and is consistent with ALAB-531. As stated:

> From the foregoing it seems quite apparent that there is neither a statutory nor a regulatory requirement that every operational detail set forth in an applicant's safety analysis report (or equivalent) be subject to a technical specification, to be included in the license as an absolute condition of operation which is legally binding upon the licensee unless and until changed with specific commission approval. Rather, as best we can discern it, the contemplation of both the act and the regulations is that technical specifications are to be reserved for those matters as to which the imposition of rigid conditions or limitations upon reactor operation is deemed necessary to obviate the possibility of an event giving rise to an immediate threat to the public health and safety.

The battery and charger technical specifications is structured to obviate the possibility of an event giving rise to an immediate threat to the public health and safety. The technical specification requires that:

> With one of the required battery banks and/or full capacity chargers inoperable, restore the inoperable battery bank and/or full capacity charger to OPERABLE status within 2 hours or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

The immediate action times for inoperable batteries and chargers is clearly reserved for immediate threats to the public health and safety.

On the other hand, use of the 200 ampere acceptance criteria in the technical specifications goes beyond immediate threats to the public health and safety. The design criteria recommended in Regulatory Guide 1.32 is an engineering standard to be applied to the design of the system to ensure sufficient margin and ruggedness. It is not intended to be used as a yardstick to measure the capability of the system to provide protection against immediate threats to the public health and safety. The technical specification, with the 150 ampere test criteria, does obviate the possibility of an event giving rise to an immediate threat to the public health and safety. The technical specification ensures that two DC power sources are available to supply the battery boards. First, the surveillance requirements on the batteries ensure that the battery is in a fully charged condition. If it is not, a limited time of 2 hours is allotted to restore the battery to the charged state. Second, a 150 ampere test on the charger ensures that the charger can supply the loads installed on the battery board. If it cannot, a limited time of 2 hours is allotted to repair the charger. Third, the limited action time of 2 hours minimizes the probability of the worst case load (accident loads) occurring during a period when the battery is inoperable.

This concurrent loading, which is effectively prohibited by the technical specifications, is the engineering standard recommended in the Regulatory Guide. It would seem that if this charger rating was intended to be used in the technical specification, a longer action time of 72 hours should be specified. The obvious parallel can be drawn to the AC power system. The onsite source (diesel generator) can be inoperable for 72 hours provided the offsite power sources are operable. Both the onsite and offsite systems are capable of powering the loads expected to be applied to the shutdown boards. The 200 ampere test criteria for the charger establishes that it can supply the battery board accident loads and recharge a dead battery. Hence, the action time should be consistent with the threat posed by losing offsite power while an onsite source is inoperable. For the diesel generators and offsite power, 72 hours is allotted. It would seem logical that a time period longer than 2 hours could be expected for the batteries and chargers. Furthermore, testing the chargers at 200 amperes rather than 150 amperes causes additional wear because of the higher heat load associated with the larger current flow. This wear is not warranted if it affords no additional protection to the public health and safety. As established above, TVA does not believe that the 200 ampere test criteria does afford additional protection unless the action time associated with the battery and charger were increased. TVA believes that the proposed 150 ampere test criteria is consistent with the design of the system when considered in the context of the technical specifications.

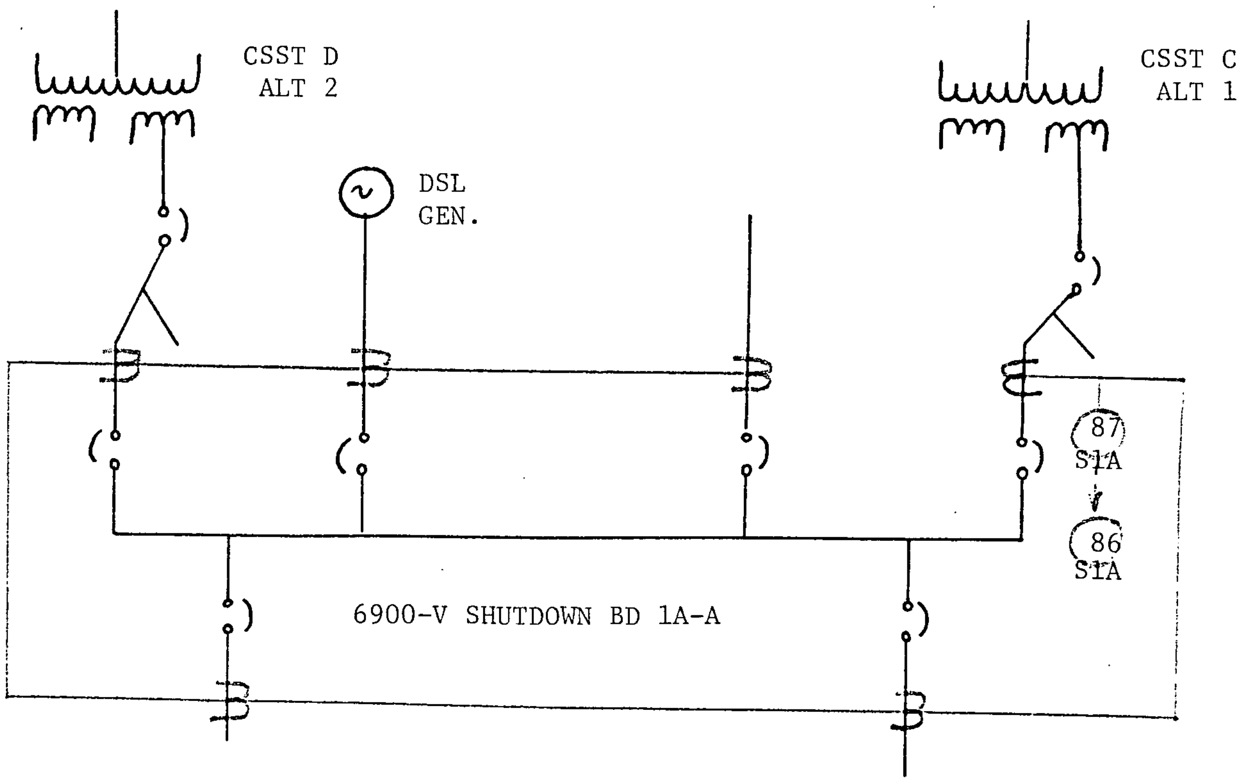
FAULTED BOARD LOCKOUT RELAY

Each 6.9-kV shutdown board is equipped with overcurrent and differential overcurrent protective relays to trip and lockout all supply breakers if a loss of voltage is caused by an overload or electrical fault, thus preventing transfer to a faulted bus.

The scheme is such that a fault (diff. OC) initiates the differential overcurrent relay (87S1A) which energizes the differential overcurrent slave relay (86S1A) which in turn initiates tripping and lockout of all the 6.9-kV shutdown board supply breakers.

TYPICAL WBNP 6900-V SHUTDOWN BOARD

SCHEME



The design of the protective scheme is such that it would require multiple failure to incapacitate both offsite power sources.

A single event such as a fault and a stuck breaker will not be transferred to the other supply because of the design logic which utilizes auxiliary contacts of the closed breaker in the close circuit of the alternate supply breakers, thus preventing transfer to the other source.

Failure of the protective relaying 87S1A or 86S1A will prevent tripping of the closed breaker. Since the 86S1A relay initiates the trip and lockout of all supply breakers to the affected board, utilizing contacts operated off the same shaft it is unlikely to assume a trip and no lockout.

Trip and lockout verification testing of the protective relays to the 6.9-kV shutdown boards was performed on Pre-operational Test - TVA 13A-RT. Any further testing of the overcurrent or differential overcurrent relay will have to be performed with both units in Mode 5 or Mode 6 only since performance of this test renders the diesel generator (supplying the board being tested) inoperable, that train of shutdown boards inoperable, and possibly result in unnecessary start of the diesel generator.

Technical Specification 4.8.1.1.2 – D/G Fuel Oil Sampling

Attached are revisions to the D/G fuel oil samplings specifications. These revisions are required to address the NRC staff concerns relating to TVA's design of its 7-day tanks which are each actually comprised of 4 separate interconnected tanks. Our design only has provisions for grab sampling from 1 of the 4 interconnected tanks and particulate sampling in accordance with ASTM-D2276-78 from only 2 of the 4 interconnected tanks which comprise the 7-day tank.

As stated in revised item C, we proposed to add a surveillance to check for water accumulation in each of the 4 interconnected tanks once per 6 months. This is in addition to the 31-day sample which checks only one tank. TVA believes it unlikely that the interconnected tanks will be significantly different. Additionally, data from Sequoyah Nuclear Plant indicates water accumulation in these tanks is uncommon. Over the previous two years they have detected water only once.

As stated in item e, we propose to add a surveillance to sample for particulate contamination every 6 months on each of the 4 interconnected tanks which comprise the 7-day tank. This is in addition to the 31-day sample which is taken from a recirculation line between two of the 4 interconnected tanks. TVA believes the particulate levels in the 4 interconnected tanks will remain relatively the same.

TVA is presently designing and procuring equipment to allow us to sample all 4 interconnected tanks in accordance with ASTM-D2276-78. We expect this capability to be available for the first 6-month interval: However, we will not be able to perform the initial performance of this surveillance. We request the footnote be added to specifications to allow us to not perform the initial surveillance. It should be noted that the surveillance requirement 4.8.1.1.2.h.1, required every 10 years, which drains the 7-day tanks and cleans them with a sodium hypochlorite solution was performed within the last two years (ref: SI 8.32).

In conclusion, TVA has agreed to add these additional surveillance requirements, procure additional equipment, and modify our system to address the NRC staff concerns. We believe these measures fully address and resolve this issue.

2) Verifying the fuel level in the 7-day fuel storage tank,

3) Verifying the fuel transfer pump starts and transfers fuel from the 7-day fuel storage tank to the engine-mounted tank,

4) Verifying the diesel starts from ambient condition and accelerates to 900 ± 18 rpm in less than or equal to 10 seconds.* The generator voltage and frequency shall be 6900 ± 690 volts and 60 ± 1.2 Hz within 10 seconds* after the start signal. The diesel generator shall be started for this test by using one of the following signals:

   a) Manual, or

   b) Simulated loss-of-offsite power by itself, or

   c) Simulated loss-of-offsite power in conjunction with an ESF actuation test signal, or

   d) An ESF actuation test signal by itself.

5) Verifying the generator is synchronized, loaded to greater than or equal to 4400 kW in less than or equal to 60 seconds,* and operates with a load greater than or equal to 4400 kW for at least 60 minutes, and

6) Verifying the diesel generator is aligned to provide standby power to the associated shutdown boards.

b. At least once per 31 days and after each operation of the diesel generator set where the period of operation was greater than or equal to 1 hour by checking for and removing accumulated water from the engine-mounted fuel tanks;

Replace with attached

c. ~~At least once per 31 days by checking for and removing accumulated water from the 7-day fuel oil storage tanks;~~

d. By sampling new fuel oil in accordance with ASTM-D4057 prior to addition to storage tanks and:

1) By verifying in accordance with the tests specified in ASTM-D975-81 prior to addition to the storage tanks that the sample has:

   a) An API Gravity of within 0.3 degrees at 60°F, or a specific gravity of within 0.0016 at 60/60°F, when compared to the supplier's certificate, or an absolute specific gravity at 60/60°F of greater than or equal to 0.83 but less than or equal to 0.89, or an API gravity of greater than or equal to 27 degrees but less than or equal to 39 degrees;

*These diesel generator set starts from ambient conditions shall be performed only once per 184 days in these surveillance tests and all other engine starts for the purpose of this surveillance testing shall be preceded by an engine prelube period and/or other warmup procedures recommended by the manufacturer so that the mechanical stress and wear on the diesel engine is minimized.

FINAL DRAFT
FEB 15 1985

b) A kinematic viscosity at 40°C of greater than ~~or~~ equal to 1.9 centistokes, but less than or equal to 4.1 centistokes, if gravity was not determined by comparison with the supplier's certification;

c) A flash point equal to or greater than 125°F; and

d) A clear and bright appearance with proper color when tested in accordance with ASTM-D4176-82.

2) By verifying within 30 days of obtaining the sample that the other properties specified in Table 1 of ASTM-D975-81 are met when tested in accordance with ASTM-D975-81 except that the analysis for sulfur may be performed in accordance with ASTM-D1552-79 or ASTM-D2622-82.

Replace with attached

e. ~~At least once every 31 days by obtaining a sample of fuel oil in accordance with ASTM-D2276-78, and verifying that total particulate contamination is less than 10 mg/liter when checked in accordance with ASTM-D2276-78, Method A;~~

f. At least once per 18 months during shutdown by:

1) Subjecting the diesel to an inspection in accordance with procedures prepared in conjunction with its manufacturer's recommendations for this class of standby service;

2) Verifying the generator capability to reject a load of greater than or equal to 600 kW while maintaining voltage (steady state) at 6900 ± 690 volts and frequency at 60 ± 1.2 Hz;

3) Verifying the generator capability to reject a load of 4400 kW without tripping. The generator voltage shall not exceed 7866 volts during and following the load rejection;

4) Simulating a loss-of-offsite power by itself, and:

a) Verifying deenergization of the shutdown boards and load shedding from the shutdown boards, and

b) Verifying the diesel starts on the auto-start signal, energizes the shutdown boards with permanently connected loads within 10 seconds, energizes the auto-connected

** This requirement is waved for the initial performance period.

c. 1) At least once per 31 days by checking for accumulated water in one of the four interconnected tanks which comprise each of the 7-day fuel oil storage tanks for each diesel generator. If water is found, the other three interconnected tanks will be checked and accumulated water removed.

2) At least once per 6 months by checking for and removing accumulated water from each of the four interconnected tanks which comprise each of the 7-day fuel oil storage tanks.

e. 1) At least once every 31 days by obtaining a sample of fuel oil from the 7 day fuel oil tanks in accordance with ASTM-D2276-78 and verifying that total particulate contamination is less than 10 mg/liter when checked in accordance with ASTM-D2276-78, Method A.

2)** At least once every 6 months by obtaining a sample of fuel oil in accordance with ASTM-D2276-78 from each of the four interconnected tanks which comprise each of the 7-day fuel oil storage tanks and verifying that total particulate contamination is less than 10 mg/liter when checked in accordance with ASTM-D2276-78, Method A.

Turbine Missile Protection

The attached revision to the FSAR includes provisions for the administrative control over changes to the turbine valve and overspeed test intervals.

0200K

10.2.3.3 High Temperature Properties

The stress-rupture properties of the high-pressure rotor material are considered to be proprietary information of the turbine manufacturer, Westinghouse Electric Corporation.

10.2.3.4 Turbine Disc Design

Information on the tangential and radial stresses in the low-pressure discs and high-pressure rotors is considered proprietary information of the turbine manufacturer, Westinghouse Electric Corporation. However, the actual maximum tangential stresses are less than those assumed in Section 10.2.3.2, above.

10.2.3.5 Preservice Inspection

10.2.3.5.1 Low Pressure Turbine Rotor

The low pressure turbine rotor and discs are heat treated nickel-chromium-molydenum-vanadium alloy steel procured to specifications that define the manufacturing method, heat treating process, and the test and inspection methods. Specific tests and test documentation, in addition to dimensional requirements, are specified for the forging manufacturer.

The low pressure turbine rotor has the following inspections and tests conducted at the forging manufacturer's plant:

1. A ladle analysis of each heat of steel for chemical composition is to be within the limits defined by the specification.

2. Following preliminary machining and heat treatment for mechanical properties but prior to stress relief, all rotor diameters and faces are subjected to ultrasonic tests defined in detail by a Westinghouse specification which is similar to the requirements of ASTM A-418.

3. After all heat treatment has been completed, the rotor forging is subjected to a thermal stability test defined by a Westinghouse specification which is more restrictive than the requirements of ASTM A-472.

4. The end faces of the main body and the fillet areas joining the body to the shaft ends of the machined forging are subjected to a magnetic particle surface inspection as defined by ASTM A-275.

5. After the bore of the rotor is finish machined, the bore is given a visual examination followed by a wet magnetic particle inspection defined in detail by a Westinghouse specification which exceeds the requirements of ASTM A-275.

6. Utilizing specimens removed from the rotor forging at specified locations, tensile, Charpy V Notch impact and FATT properties are determined following the test methods defined by ASTM A-370.

In addition, after the rotor body is finished machined, the rotor surface is given a fluorescent magnetic particle examination as defined by a Westinghouse specification which is similar to ASTM E-138.

The low pressure turbine rotor discs have the following inspections and tests conducted at the forging manufacturer's plant:

1. The ladle analysis of each heat of steel is to be within the composition limits defined by the specification.

2. After all heat treatment, rough machining and stress relief operations, the hub and rim areas of the completed disc forging are subjected to ultrasonic examinations. These ultrasonic tests are defined by a Westinghouse specification which exceeds the requirements of ASTM A-418.

3. The tensile, Charpy V Notch impact and FATT properties are determined from specimens removed from the discs at specific locations. The test methods used for determining these mechanical properties are defined by ASTM A-370.

In addition, after the discs are finish machined, the disc surfaces, except blade grooves, are given a fluorescent magnetic particle examination as defined by a Westinghouse specification which is similar to ASTM E-138.

After the preheated discs are assembled to the rotor body to obtain the specified interference fit, holes are drilled and reamed for axial locking pins at the rotor and disc interface. These holes are given a fluorescent penetrant inspection defined by a Westinghouse specification which is similar to ASTM E-165. Prior to shipping, each fully bladed rotor is balanced and tested to 120% of rated speed in a shop heater box.

10.2.3.5.2 High Pressure Turbine Rotor

The high pressure turbine rotor for low temperature light water reactor applications has the same basic material composition as the low pressure rotors. This nickel-chromium-molybdenumvanadium alloy steel forging is procured, processed, and subjected to test and inspection requirements the same as the low pressure rotor, which include:

1. Ladle analysis
2. Ultrasonic tests
3. Magnetic particle inspection
4. Thermal stability test
5. Bore inspection
6. Tensile and impact mechanical properties
7. Fluorescent magnetic particle inspection
8. Heater box and 120% speed test

10.2.3.5.3 Preoperational and Initial Startup Testing

The complete turbine generator control system including the turbine overspeed protection system is given a thorough prestart check and initial startup test verficiation during the preoperational and hot functional tests and initial heatup of the plant. These tests are documented in section 14.0 of this FSAR.

10.2.3.6 Inservice Inspection

10.2.3.6.1 Turbine Rotors

To help guard against possible failure of low pressure nuclear steam turbine discs, Westinghouse Electric Corporation has developed an ultrasonic in-service inspection method for these discs. The program includes methods and hardware for field inspection of LP turbine discs for incipient cracking located at their bore surface and particularly at their keyways.

The inspection intervals recommended by Westinghouse and based on NRC criterion vary with the construction and makeup of each rotor (and discs). The recommended Westinghouse inspection intervals for the initial WBN rotors vary between 3.34 years and 4.65 years on the various LP rotors and are based on actual operating time. If the initial rotors are replaced or refurbished, the rotor disc inspection intervals will be either approximately every five years based on actual operating time or the Westinghouse inspection interval based on the NRC criterion, whichever provides the lesser inspection interval. In addition, if there is evidence of significant corrosion found during any of the low pressure turbine rotor inspections, Westinghouse will be consulted and the inspection intervals adjusted accordingly. If measurable cracks are detected, the inspection intervals will be adjusted after considering Westinghouse recommendations. The disc inspections will be performed by personnel that are expert and highly skilled in their field.

10.2.3.6.2 Turbine Overspeed Protection

In order to assure that the Turbine Overspeed Protection System (TOPS) continues to carry out its design function in a highly reliable manner, a rigorous program of inspecting, testing, maintaining, and calibrating the various parts of the TOPS will be developed. The development of this program will consider the recommendations of Westinghouse. Various aspects of the TOPS inspection program such as scope and frequency of test, inspections, and other pertinent items are described in the following paragraphs.

The TOPS include the following major component groups:

a. Turbine valves which control or prevent steam admission into either the high pressure or low pressure turbines.

b. The control valve emergency trip, stop valve emergency trip, and autostop oil trip systems which include the mechanical overspeed trip, electrical overspeed trip, and the overspeed protection controllers. (See section 10.2.2 for additional details).

The throttle valves, governor valves, reheat stop valves and reheat intercept valves will be tested and visually checked after each turbine startup and at intervals of approximately one month to verify complete freedom of valve stem travel. The interval of valve testing may be changed based on plant conditions or overall TVA power system conditions. For example, if equipment necessary to shut the unit down is inoperable, the valve testing would be postponed to avoid the potential for tripping the unit. Also, if the demand for power on the TVA system is large enough that the loss of a unit would create a shortage of power to the system, the testing would wait until more favorble conditions exist. Insert Extraction and MSR drain non-return valves will be tested during refueling outages. Additionally, one or more of each valve type will be disassembled and inspected during outages with all throttle and governor valves being disassembled and inspected

Page 10.2-9a Insert

The interval for testing turbine valves shall not exceed 1.25 times the required test interval without prior approval of the plant manager, and no more than two consecutive tests shall be deferred without the prior review and approval by the Plant Operations Review Committee (PORC).

initially at least once every 39 operating months with the interval being reevaluated later if there are no significant valve problems or defects. All of the remaining valves (reheat stop, reheat intercept, and above non-return valves) will be disassembled and inspected at least once every 60 operating months (once every three refueling cycles). If during the inspection of one type of valve a problem or defect is noted, all similar valves will be disassembled and inspected. These inspections will consist of detailed dimensional and related checks to assure that critical clearances and fits are maintained within the manufacturer's recommendations.

During each unit startup prior to synchronizing the unit if the turbine remote and overspeed trips have not been tested during the previous six months of operation, the remote solenoid, the overspeed protection controller, the mechanical overspeed, and the backup electrical overspeed trips will each be actuated to verify proper turbine and valve action. If the unit operates continuously for periods longer than six months and there have been no significant problems with the overspeed trip weight mechanism, the above remote and overspeed tests will be deferred until the unit is shutdown and performed during the subsequent startup. The remote solenoid and overspeed trip tests will trip the turbine and close all throttle, governor, reheat intercept, and reheat stop valves. The overspeed protection controller trip test includes verification of closure of the turbine governor and reheat intercept valves. Additionally, the overspeed trip oil device which provides an interface between the autostop oil trip system and the mechanical overspeed trip is tested at approximately monthly intervals. This device utilizes high pressure oil to force the overspeed trip weight outward against spring force until it strikes the trigger and actuates an overspeed trip. The above test simulates an actual overspeed trip by comparing the oil pressure at which the mechanism operates with previous test readings. No steam admission or control valves are actuated which allows on-line testing of this feature. This testing is also repeated following repair or adjustment to the turbine electrohydraulic control system.

Replace with attached

Calibration and checks of TOPS overspeed protection circuits overspeed controller and components (speed sensors, including OPC and electrical trip sensors, pressure sensors, load sensors, reference signals, comparators, relays, solenoid valves, etc.) is performed during each refueling outage (approximately once every 18 months) or following major modifications or adjustments to this system. These calibrations and checks can only be performed safely with the unit off-line.

Page 10.2-9b Replacement Paragraphs

The overspeed trip oil device which provides an interface between the autostop oil trip system and the mechanical overspeed trip is tested at approximately monthly intervals. This device utilizes high pressure oil to force the overspeed trip weight outward against spring force until it strikes the trigger and actuates an overspeed trip. The above test simulates an actual overspeed trip by comparing the oil pressure at which the mechanism operates with previous test readings. No steam admission or control valves are actuated which allows on-line testing of this feature. This testing is also repeated following repair or adjustment to the turbine electrohydraulic control system.

Additionally, during each unit startup prior to synchronizing the unit if the turbine remote and overspeed trips have not been tested during the previous six months of operation, the remote solenoid, the overspeed protection controller, the mechanical overspeed, and the backup electrical overspeed trips will each be actuated to verify proper turbine and valve action. If the unit operates continuously for periods longer than six months and there have been no significant problems with the overspeed trip weight mechanism, the above remote and overspeed tests will be deferred until the unit is shutdown and performed during the subsequent startup. The remote solenoid and overspeed trip tests will trip the turbine and close all throttle, governor, reheat intercept, and reheat stop valves. The overspeed protection controller trip test includes verification of closure of the turbine governor and reheat intercept valves.

The monthly on-line test of the mechanical overspeed trip device and the six month off-line test of the turbine remote and overspeed trips will not be deferred for longer than 1.25 times the required test interval without the performance of an engineering evaluation and the review and approval of the Plant Operations Review Committee (PORC).

10.2.3.6.3 Other Turbine Protection Features

There are other turbine protection features which serve to trip the turbine during abnormal operation (see section 10.2.4 for a list of mechanical and electrical turbine trips). Inspections, tests, maintenance, and calibrations of these components will be based on Westinghouse recommendations.

10.2.4 Evaluation

The following operational transients which are caused by operation of turbine, generator, or distribution system protection equipment, can occur:

1. Turbine trip due to turbine abnormalities.

2. Turbine trip due to generator abnormalities.

3. Transients due to rapid load changes or system abnormalities.

All turbogenerator protective trips that will automatically trip the turbine due to turbine (mechanical) and generator (electrical) abnormalities are tabulated below. Reactor trip and safety injection signals also will automatically trip the turbine. All turbine trips except for the first three trips tabulated in the turbine (mechanical) abnormalities list below are also shown in Figure 10.2-1.

I. Automatic Turbine Trips Due To Turbine (Mechanical) Abnormalities

1. Low Bearing Oil Pressure Trip
2. Low Vacuum Trip
3. High Thrust Bearing Trip
4. High Turbogenerator Viberation Trip
5. Low Differential Water Pressure Across Generator Stator Coils Trip (Alarm only below 15 percent power)
6. High Stator Coil Outlet Water Temperature Trip (Alarm only below 15 percent power)
7. Low EHC Fluid Tank Level
8. Low Lube Oil Tank Pressure
9. Low EHC Fluid Pressure Trip
10. Low Auto Stop Oil Pressure Trip
11. 111 Percent Rated Speed Electrical Overspeed Trip
12. 111 Percent Rated Speed Mechanical Overspeed Trip
13. EHC DC Power Failure Trip
14. Loss of Both Main Feedwater Turbines Trip
15. Steam Generator High-High Level Trip

II. Automatic Turbine Trips Due To Generator (Electrical) Abnormalities

1. Generator Differential Current Trip
2. Generator Neutral Overvoltage Trip
3. Generator Time Overcurrent (Voltage Supervised) Trip
4. Generator Negative Sequence Trip
5. Generator Backup and Main Transformer Feeder Differential Trip
6. Generator Reverse Power Trip
7. Unit Station Service Transformer A Overcurrent Trip
8. Unit Station Service Transformer B Overcurrent Trip
9. Main Transformer Sudden Pressure Trip
10. Main and Unit Station Service Transformers Differential Trip
11. 500 kV Bus 2, Section 3 Breaker Failure Trip
12. 500 kV Bus 2, Section 3 Differential Set 1 Trip

FINAL DRAFT

3/4.3.4 TURBINE OVERSPEED PROTECTION

LIMITING CONDITION FOR OPERATION

3.3.4 At least one Turbine Overspeed Protection System shall be OPERABLE.

APPLICABILITY: MODES 1, 2*, and 3*

ACTION:

a. With one stop valve or one control valve per high pressure turbine steam line inoperable and/or with one reheat stop valve or one reheat intercept valve per low pressure turbine steam line inoperable, restore the inoperable valve(s) to OPERABLE status within 72 hours, or close at least one valve in the affected steam line(s) or isolate the turbine from the steam supply within the next 6 hours.

b. With the above required Turbine Overspeed Protection System otherwise inoperable, within 6 hours isolate the turbine from the steam supply.

c. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.4.1 The provisions of Specification 4.0.4 are not applicable.

4.3.4.2 The above required Turbine Overspeed Protection System shall be demonstrated OPERABLE:

a. At least once per 7 days by cycling each of the following valves through at least one complete cycle from the running position:

(1) Four high pressure turbine stop valves,
(2) Four high pressure turbine control valves,
(3) Four low pressure turbine reheat stop valves, and
(4) Four low pressure turbine reheat intercept valves.

b. At least once per 31 days by direct observation of the movement of each of the above valves through one complete cycle from the running position,

c. At least once per 18 months by performance of a CHANNEL CALIBRATION on the Turbine Overspeed Protection Systems, and

d. At least once per 40 months by disassembling at least one of each of the above valves and performing a visual and surface inspection of valve seats, disks, and stems and verifying no unacceptable flaws or excessive corrosion. If unacceptable flaws or excessive corrosion are found, all other valves of that type shall be inspected.

OCT 26 1984

* Specification not applicable with all main steam isolation valves in the closed position and all other steam flow paths to the turbine isolated.

6.8.5 PROCEDURES AND PROGRAMS (Continued)

c. Secondary Water Chemistry

A program for monitoring of secondary water chemistry to inhibit steam generator tube degradation. This program shall include:

1) Identification of a sampling schedule for the critical variables and control points for these variables,

2) Identification of the procedures used to measure the values of the critical variables,

3) Identification of process sampling points,

4) Procedures for the recording and management of data,

5) Procedures defining corrective actions for off-control point chemistry conditions,

6) Procedures identifying: (1) the authority responsible for the interpretation of the data; and (2) the sequence and timing of administrative events required to initiate corrective ACTION, and

7) Monitoring of the condensate at the discharge of the condensate pumps for evidence of condenser in-leakage. When condenser in-leakage is confirmed, the leak shall be repaired, plugged, or isolated.

d. Post-accident Sampling

A program which will ensure the capability to obtain and analyze reactor coolant, radioactive iodines and particulates in plant gaseous effluents, and containment atmosphere samples under accident conditions. The program shall include the following:

1) Training of personnel,

2) Procedures for sampling and analysis, and

3) Provisions for maintenance of sampling and analysis equipment.

e. Turbine Integrity Program with Turbine Overspeed Protec (TIPTOP)

{continued on following page}

e. Turbine Integrity Program with Turbine Overspeed Protection (TIPTOP)

1. The TVA TIPTOP program includes a comprehensive program of maintenance, calibration, inspection, and testing of the turbine overspeed protection system (TOPS).

2. The overall objective of this program is to maintain the high reliability of the turbine overspeed protection system.

3. The maintenance program includes inspection and maintenance of the throttle, governor, reheat stop, intercept valves, and extraction steam and MSR drain nonreturn valves during outages.

4. The calibration program includes calibration of the turbine overspeed protection system.

5. The testing program includes testing of the high-pressure turbine governor and throttle valves and the turbine overspeed protection system.

6. The TIPTOP program will be based on the vendors recommendation and any changes to the program will be made with the concurrence of the vendor.